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Precursors to Gender Attitudes in the Air Cadet Gliding Population

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This paper reflects the opinion of the authors, which is not necessarily that of Defence R&D Canada, the Department of National Defence, or the Director of Flight Safety.

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In conducting the research described in this report, the investigators adhered to the policies and procedures set out in the Tri-Council Policy Statement: Ethical conduct for research involving humans, National Council on Ethics in Human Research, Ottawa, 1998 as issued jointly by the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council of Canada and the Social Sciences and Humanities Research Council of Canada.

Abstract

Directorate of Flight Safety (DFS) data between 1997 and 2007 suggest that a disproportionate number of female pilots are involved in Canadian air cadet glider accidents. Research also suggests that commercial aviation continues to be dominated by “masculine” cultural values and practices, possibly leading to feelings of pressure among females to perform, as well as prejudicial attitudes towards female aviators (Davey, 2004; Vermeulen & Mitchell, 2007). Research by Febbraro, Gill, Holton, and Hendriks (2008) also found differential treatment of males and females in the Canadian air cadet glider training environment. All of these factors suggest that female air cadets may be exposed to negative attitudes and expectations and may encounter stereotype threat (i.e., negative gender stereotypes) in flight situations. Such negative stereotypes or attitudes could, in turn, play a role in the deficit in performance among female cadets, and possibly contribute to the number of accidents attributed to females. This study explored the precursors to negative gender attitudes in an attempt to identify some of the key factors that contribute to stereotype threat. Structural equation modeling based on survey findings from a sample of male and female air cadets (N=211) indicated that an awareness of pilot limitations and rational thinking patterns predicted aviation gender attitudes (AGA). Knowing the precursors to negative AGA could point to a mechanism by which these attitudes, and therefore, the environment encountered by female cadets, may be altered to increase their confidence and decrease the stereotype threat, thus potentially leading to fewer accidents.

Résumé

Les données de la Direction de la sécurité des vols de 1997 à 2007 indiquent qu’un nombre disproportionné de femmes pilotes sont en cause dans les accidents de planeur chez les Cadets de l’Air au Canada. Les recherches indiquent aussi que l’aviation commerciale continue à être dominée par les valeurs et pratiques culturelles « masculines », ce qui peut amener les femmes à se sentir poussées à avoir un rendement impeccable et mener à des attitudes préjudiciables à l’endroit des femmes pilotes (Davey, 2004; Vermeulen et Mitchell, 2007). L’étude menée par Febbraro, Gill, Holton et Hendriks (2008) révélait également une différence de traitement entre les hommes et les femmes dans le contexte de la formation de pilotage de planeurs chez les Cadets de l’Air au Canada. Tous ces facteurs indiquent que les femmes pilotes peuvent être exposées à des attitudes et à des attentes négatives ainsi qu’à la menace du stéréotype (stéréotypes négatifs en fonction du sexe) dans une situation de vol. De telles attitudes ou de tels stéréotypes négatifs pourraient entraîner une diminution du rendement des cadettes et, ainsi, contribuer au nombre d’accidents causés par les femmes. Cette étude tente de dégager certains des facteurs clés qui contribuent à la menace du stéréotype en explorant les signes précurseurs des attitudes négatives liées au sexe. Une modélisation par équation structurelle se fondant sur les résultats d’un sondage mené à partir d’un échantillon d’hommes et de femmes appartenant aux Cadets de l’Air (N = 211) a révélé que la connaissance des limites des pilotes et les modes de raisonnement rationnel prédisaient certaines attitudes liées au sexe. La connaissance des signes précurseurs négatifs de ces attitudes liées au sexe pourrait permettre de trouver un mécanisme par lequel ces attitudes (et, par conséquent, l’environnement dans lequel se trouvent les cadettes), peuvent être modifiées pour améliorer leur confiance et diminuer la menace du stéréotype, ce qui pourrait entraîner une réduction du nombre d’accidents.

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Executive summary

Precursors to Gender Attitudes in the Air Cadet Gliding Population

Emily-Ana Filardo; Angela R. Febbraro; Ritu M. Gill; DRDC Toronto TR 2009-199; Defence R&D Canada – Toronto; March 2011.

Introduction and background: Directorate of Flight Safety (DFS) data between 1997 and 2007 suggest that a disproportionate number of female pilots are involved in Canadian air cadet glider accidents. Research also suggests, however, that compared to males, female flight students may be quicker to grasp instrument flight; have far fewer fatal accidents; tend to learn procedures correctly and be more consistent in using them; tend to operate the controls of an airplane more skilfully; and may be less likely to fly into dangerous weather or "show off" for spectators (Sitler, 2004). Yet, female flight students may also have less technical background/experience; may be more fearful of stalls or other unusual attitudes; may be slower to gain confidence; and may be more apprehensive about their first solo flight. Research also suggests that commercial aviation continues to be dominated by "masculine" cultural values and practices, possibly leading to feelings of pressure among females to perform above average, as well as prejudicial attitudes towards female aviators (Davey, 2004; Vermeulen & Mitchell, 2007). All of these factors indicate that female cadets may be exposed to negative attitudes and expectations and may encounter stereotype threat (e.g., negative gender stereotypes) in flight situations. Stereotype threat occurs when a negative stereotype exists about a group's expected behaviour in a particular situation (Steele & Aronson, 1995). Accordingly, the fear of being judged based on group membership and/or based on the negative stereotype about females' piloting abilities may create deficits in performance, which, in the aviation environment, could lead to an increase in the number of accidents attributed to females. This study explored the precursors to negative gender attitudes in an attempt to identify some of the key factors that contribute to stereotype threat in this context.

Results: Structural equation modeling based on survey findings from a sample of male and female air cadets (N=211) indicated that having an awareness of pilots' limitations negatively impacted aviation gender attitudes (AGA) (i.e., was associated with a less positive attitude towards female pilots). Further, having a rational thinking pattern predicted higher scores with regards to AGA (i.e., a more positive attitude towards female pilots). Knowing the precursors to negative AGA could point to a mechanism by which these attitudes, and therefore, the environment encountered by female cadets, may be altered to increase their confidence and decrease the stereotype threat, thus potentially leading to fewer accidents.

Significance: This research suggests that people's beliefs about pilot limitations and their rational style of thinking predict their gender attitudes in aviation. More specifically, while female pilots are viewed as following regulations more closely, they are also viewed as both less confident and less proficient. The implication is that female pilots are viewed as overly cautious and are, therefore, more severely scrutinized than male pilots. The prevalence of these attitudes in the air cadet gliding population may result in a situation of stereotype threat where females are expected to perform poorly. The added pressure that their performance is a reflection not only of their individual capability, but also of the capabilities of all female pilots, could be reflected in their over-cautiousness, their lack of flexibility/proficiency in unexpected circumstances, and their lack of confidence in their own abilities in a self-fulfilling prophecy. Altering the circumstances that lead to stereotype threat situations for female pilots (i.e., rendering the stereotype irrelevant) could increase their performance and decrease the number of accidents attributed to female pilots. One way of eliminating the stereotype threat

situation would be to alter the relationship between negative AGA and its precursors, specifically targeting the relationship between the beliefs about pilot limitations and AGA since that tends to point to the idea that female pilots are perceived to have more limited ability than male pilots. Changing this relationship to a positive or a neutral one could remove the pressure on female pilots to perform, allowing them to relax and potentially perform at a higher level.

Future plans: Flight simulations that alter the stereotype threat present in the situation could lead to a better understanding of the impact of stereotype threat on flight performance in females. A future study that alters the presence of stereotype threat and measures the performance of male and female pilots is a logical next step in the investigation of the discrepancy in accidents between males and female pilots.

Sommaire

Signes précurseurs des attitudes liées au sexe chez les Cadets de l'Air pilotant des planeurs

Emily-Ana Filardo, Angela R. Febbraro, Ritu M. Gill; RDDC Toronto TR 2009-199; Recherche et développement pour la défense Canada – Toronto, mars 2011.

Introduction et contexte : Les données de la Direction de la sécurité des vols de 1997 à 2007 indiquent qu’un nombre disproportionné de femmes pilotes sont en cause dans les accidents de planeurs chez les Cadets de l’Air au Canada. Toutefois, les recherches indiquent aussi qu’en comparaison des hommes, les élèves pilotes de sexe féminin peuvent saisir plus rapidement les instruments de vol, elles ont beaucoup moins d’accidents mortels, elles ont tendance à apprendre les procédures correctement et à les appliquer de manière plus uniforme, elles ont tendance à actionner plus habilement les commandes d’un avion; et elles sont moins enclines à piloter par temps risqué ou à tenter « d’éblouir » les spectateurs (Sitler, 2004). Pourtant, les élèves pilotes de sexe féminin peuvent aussi avoir moins d’expérience sur le plan technique; elles peuvent craindre davantage les décrochages ou autres situations inhabituelles; elles peuvent mettre plus de temps à gagner confiance en elles et elles peuvent craindre davantage leur premier vol en solo. Les recherches indiquent aussi que le monde de l’aviation commerciale est toujours dominé par les valeurs et pratiques culturelles « masculines », ce qui peut amener les femmes à se sentir poussées à avoir un rendement plus élevé que la moyenne et conduire à des attitudes préjudiciables à l’endroit des femmes pilotes (Davey, 2004; Vermeulen et Mitchell, 2007). Tous ces facteurs indiquent que les cadettes peuvent être exposées à des attitudes et à des attentes négatives et à la menace du stéréotype (stéréotypes négatifs liés au sexe) dans des situations de vol. La menace du stéréotype découle de la présence d’un stéréotype négatif au sujet d’un comportement attendu de la part d’un groupe dans une situation donnée (Steele et Aronson, 1995). Par conséquent, la crainte d’être jugée en fonction de l’appartenance au groupe ou en fonction du stéréotype négatif concernant la capacité des femmes pilotes peut occasionner des lacunes sur le plan du rendement, ce qui, dans le contexte de l’aviation, pourrait entraîner une hausse du nombre d’accidents mettant en cause des femmes. Cette étude tente de dégager certains des facteurs clés qui contribuent à la menace du stéréotype dans ce contexte en explorant les signes précurseurs des attitudes négatives liées au sexe.

Résultats : Une modélisation par équation structurelle se fondant sur les résultats d’un sondage mené à partir d’un échantillon d’hommes et de femmes appartenant aux Cadets de l’Air (N = 211) a révélé que la connaissance des limites des pilotes se répercute de manière négative sur les attitudes liées au sexe dans le monde de l’aviation (c.-à-d. qu’elle est associée à une attitude moins positive envers les femmes pilotes). De plus, le fait de recourir à un mode de raisonnement rationnel permettait de prédire des résultats plus élevés à l’égard des attitudes liées au sexe dans ce domaine (c.-à-d. une attitude plus positive à l’égard des femmes pilotes). La connaissance des signes précurseurs négatifs de ces attitudes pourrait permettre de trouver un mécanisme par lequel ces attitudes (et, par conséquent, l’environnement dans lequel se trouvent les cadettes), peuvent être modifiées pour améliorer leur confiance et diminuer la menace du stéréotype, ce qui pourrait entraîner une réduction du nombre d’accidents.

Importance : Cette étude indique que la perception quant aux limites des pilotes et leur mode de raisonnement rationnel sont des prédicteurs de leurs attitudes liées au sexe dans le domaine de

l’aviation. C’est-à-dire que, même si les femmes pilotes sont perçues comme suivant plus rigoureusement la réglementation, elles sont aussi perçues comme ayant moins confiance en elles et comme étant moins compétentes. Les femmes pilotes seraient donc perçues comme trop prudentes et, par conséquent, seraient suivies de plus près que les pilotes masculins. L’incidence de ces attitudes chez les Cadets de l’Air pilotes de planeurs peut entraîner des situations où une menace du stéréotype fait que l’on s’attend à un piètre rendement de la part des femmes. La pression ajoutée par le fait que leur rendement relève non seulement leur capacité individuelle, mais aussi des capacités de toutes les femmes pilotes prises globalement, les inciterait à manifester une extrême prudence, à manquer de flexibilité et à être moins compétentes en situation inattendue, ainsi qu’à manquer de confiance dans leurs propres capacités, ce qui alimente les stéréotypes. Le fait de modifier les circonstances menant aux situations où plane la menace du stéréotype pour les femmes pilotes (en désamorçant le stéréotype) pourrait améliorer leur rendement et diminuer le nombre d’accidents où elles sont impliquées. Une façon d’éliminer les situations où surgit la menace du stéréotype serait de modifier le lien entre les attitudes négatives liées au sexe et leurs signes précurseurs en ciblant précisément le lien entre les préjugés au sujet des limites des pilotes et les attitudes liées au sexe, puisque cette situation tend à indiquer que les femmes pilotes sont perçues comme ayant une capacité plus limitée que les pilotes masculins. La transformation de ce lien en un lien positif ou neutre permettrait d’éliminer chez les femmes pilotes la pression qu’elles ressentent de devoir afficher un rendement supérieur, ce qui leur permettrait de se détendre et pourrait mener à de meilleurs résultats.

Perspectives : Des simulations de vol modifiant la menace du stéréotype notée dans une situation donnée pourraient permettre de mieux comprendre les répercussions de la menace du stéréotype sur le rendement des femmes. Une étude future qui modifie la présence de la menace du stéréotype et qui mesure le rendement des hommes et des femmes pilotes est la prochaine étape logique pour étudier l’écart entre les hommes et les femmes quant au nombre d’accidents dont ils sont responsables.This page intentionally left blank.

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1 Introduction

According to data collected by the Directorate of Flight Safety (DFS), female air cadets have been over-represented in air cadet glider accidents in Canada. DFS records between 1997 and 2007 indicate that while female air cadets represent approximately 25% of the air cadet gliding population in Canada (and 25% of instructors), they are involved in approximately 75% of the glider accidents as either pilot at the controls, instructor, or solo monitor. An understanding of the circumstances that have led to this disproportionate representation of females in gliding accidents could point to areas that might be altered, resulting in fewer accidents.

One important area of understanding with regards to performance is expectation, which is linked to attitudes. Research suggests that prejudicial attitudes towards female aviators continue to exist, and that commercial aviation continues to be dominated by "masculine" cultural values and practices, possibly leading to feelings of pressure among females to perform well above average, as well as feelings of isolation or exclusion (Davey, 2004; Davey & Davidson, 2000; Kristovics, Mitchell, Vermeulen, Wilson, & Martinussen, 2006; Vermeulen & Mitchell, 2007). Indeed, a study of attitudes towards flight safety at the Regional Gliding School in Atlantic Canada suggested the existence of a strong culture with components of "macho, invulnerability, and antiauthority" (Dutcher, 2001, p. 34). Davey and Davidson also point out that female pilots feel "on display" due to their prominence, being in such an overwhelming minority. As a result, any mistakes that are made by female pilots are felt to be much more conspicuous than those of male pilots.

This hyper vigilance with regards to the meaning of their behaviour for female pilots may lead to situations akin to stereotype threat. Stereotype threat is defined as the fear by a member of a stereotyped group that they will, by their behaviour, confirm the stereotype in a particular situation in which the stereotype exists (Steele & Aronson, 1995). In their seminal paper, Steele and Aronson (1995) argue that the self-threat that arises as a function of the possibility of being judged based on a negative stereotype may interfere with the performance of the stereotyped group. In a series of studies, they showed that Black students taking a test that was classified as a measure of ability performed worse, were more likely to distance themselves from interests that might classify them as stereotypically Black, and were more aware of Black stereotypes than White participants or Black participants who were told that they were taking a non-diagnostic test.

The impact of stereotype threat, however, can be altered by changing the applicability of the stereotype to that particular situation. For example, Spencer, Steele, and Quinn (1999; Study 2) found that when women were told that a test demonstrates gender stereotypes, they under-performed compared to men; however, this was not the case when the women were told that the test is gender neutral. Framing of tasks has also been shown to have a large impact on the influence of stereotype threat on performance. Through framing, stereotype threat may be induced in non-stereotyped groups (on one dimension, such as gender) given the right comparison (on another dimension, such as race). For example, Aronson et al. (1999) showed that, compared to control participants, White males underperformed on a math test after reading about the performance of Asian males, a group stereotyped as excelling in mathematics. In a series of studies by Stone, Lynch, Sjomeling, and Darley (1999), the performance of participants was differentially affected by the framing of the task. The performance of Black participants on a golf

task decreased when they were told that the task measured “athletic intelligence,” while the performance of White participants decreased when they were told that the task measured “natural athletic ability.”

One particularly interesting phenomenon with regards to stereotype threat is that stereotype threat is triggered whenever an individual is in a situation where they know a negative stereotype exists about their expected performance regardless of their actual belief in the stereotype (Osborne, 2001). As an example, women in math-oriented fields presumably have great faith in their mathematical ability and yet, when faced with a challenging new task, the math-gender stereotype is activated, ostensibly causing them to perform below their anticipated capability. Therefore, despite the fact that an individual denies the applicability of any particular stereotype to themselves (e.g., a woman in a math-oriented field would likely deny that the stereotype that women are not good at math applies to her specifically), they are influenced negatively by the possibility that their actions might be judged in terms of the stereotype.

Another by-product of stereotype threat, according to Stone (2002), is self-handicapping. In Stone’s study of athletic performance, White participants who were told that a sports test measured “natural athletic ability,” which presumably triggered stereotypes about athletic inferiority, were less likely to practice than were control participants who were told that the test measured “psychological factors associated with general sports performance.” Thus, behaviour consistent with a negative stereotype may be triggered by that stereotype, much like a self-fulfilling prophecy.

In the case of aviation, female aviators, feeling the pressure to perform above average in order to “keep up” with the males, may actually over-learn the technical/operational aspects of flying while remaining insecure about their actual flying abilities, which in turn, may make them apprehensive and overly cautious in flight. Paradoxically, this focus on being overly cautious results in poorer performance, especially in emergency situations where decisions must be made quickly with little time to weigh out the safest course of action. Unfortunately, this poor performance is consistent with the existing negative gender stereotypes often leading to a sense of justification of these beliefs.

Research also suggests a mixed picture regarding gender differences in aviation safety. For instance, compared to males, female flight students may be quicker to grasp instrument flight; have far fewer fatal accidents; tend to learn procedures correctly and are more consistent in using them; tend to operate the controls of an airplane more skilfully; and may be less likely to fly into dangerous weather or “show off” for spectators (Sitler, 2004). However, in comparison to their male counterparts, female flight students may also have less technical background/experience; may be more fearful of stalls or other unusual attitudes; may be slower to gain confidence; and may be more apprehensive about their first solo flight (Sitler, 2004; Vermeulen & Mitchell, 2007). Further, in interviews conducted with Canadian air cadets and instructors, Febbraro, Gill, Holton, and Hendriks (2008) found that both groups felt that female pilots were treated differently from male pilots during training. Participants indicated that female cadets were generally less confident and more emotional than their male counterparts, and that feedback from instructors to female cadets was tailored to this sensitivity, whereas males, who were perceived as over-confident, were seen as able to endure harsh criticism of their performance. Unfortunately, this differential, “sensitive” treatment of female cadets may have the inadvertent effect of re-affirming the existence of gender stereotypes in the air cadet glider pilot population.

1.1 Purpose of the Present Study

The primary purpose of the present study was to investigate the attitudes and traits that lead to negative gender attitudes in the air cadet gliding population. Negative gender attitudes may have important implications for the discrepancy found in the performance of male and female air cadets in the gliding population. Negative beliefs and expectancies about female competency could lead to an environment that breeds stereotype threat, which could account, in part, for the decreased performance of female air cadet pilots.

In order to investigate the precursors to negative gender attitudes, data originally collected by Febbraro et al (2008), who investigated social psychological and human factors in relation to gender differences in air cadet gliding accidents, were used to assess a prediction model using structural equation modeling (SEM) (see Figure 1). The advantage of using SEM for this type of analysis is that it allows the researcher to posit an explanatory model using latent variables that takes into account measurement error (Raykov & Marcoulides, 2000).

As noted earlier, the current aviation culture appears to accept female pilots reluctantly, and seems to assume that female pilots are under-skilled and overly cautious. The hypothesized model predicts that stereotypically “macho” beliefs with regards to safety will negatively predict attitudes towards women in aviation. The prevalent belief of invulnerability associated with such macho attitudes is predicted to show a similar pattern.

Finally, as discussed, research has shown that female pilots learn the controls faster, are safer, and less likely to “show off” than male pilots. Individuals who think rationally should, therefore, see these positive attributes of female pilots and present positive attitudes towards women in aviation. On the other hand, stereotypes are irrational, often emotional thoughts, therefore, it was predicted that experiential thinking, in contrast to rational thinking, would lead to a more negative attitudes towards women in aviation. Therefore, the hypothesized model predicts that rational thinking will lead to more positive attitudes towards female pilots, while experiential/emotional thinking will lead to more negative attitudes towards female pilots.

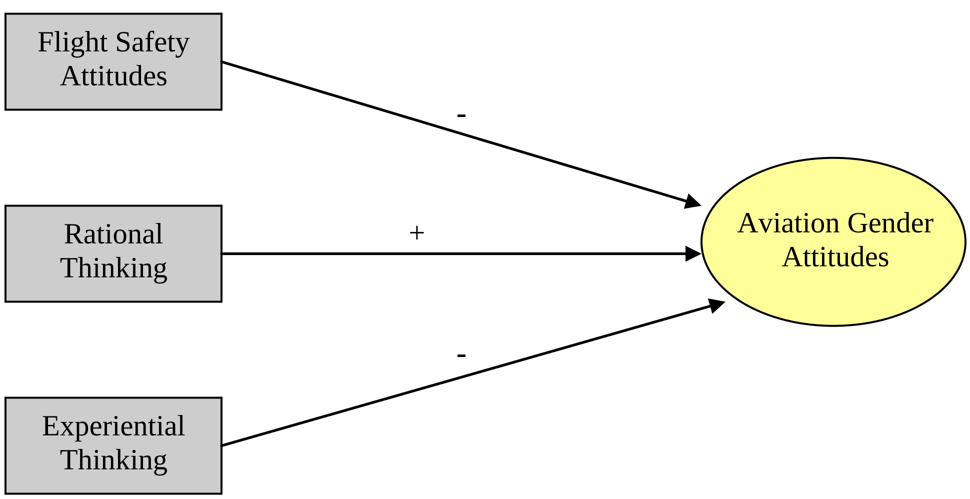

Figure 1. Hypothesized SEM predicting attitudes towards women in aviation (i.e., Aviation Gender Attitudes)

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2 Method

2.1 Participants

Febbraro et al (2008) collected data from 222 (170 males, 51 females, 1 unspecified) current and past air cadets via paper survey[1]. Participants ranged in age from 15 to 19 (*M* = 16.40, *SD* = 0.71) and had been in aviation from 0 to 5 years (*M* = 0.84, *SD* = 0.81). Participants were recruited from five Regional Gliding Centres across Canada: Atlantic Region (Debert, Nova Scotia), Eastern Region (St. Jean sur Richelieu, Quebec), Central Region (Trenton, Ontario), Prairie Region (Gimli, Manitoba), and Pacific Region (Comox, British Columbia).

2.2 Measures

2.2.1 Flight Safety Attitudes

Febbraro et al (2008), following Dutcher (2001), included 19 items from Simpson and Wiggins' (1999) 25-item scale, which measured participant attitudes towards unsafe acts within aviation (see Annex A). Participants were asked to respond to the items using a 5-point Likert scale, ranging from *Strongly Disagree* (1) to *Strongly Agree* (5). According to Simpson and Wiggins, the scale was designed to measure two types of behavioural patterns that reflect unsafe acts: violations, which are deviations from rules and procedures (e.g., "Accidents generally occur because people do not follow the rules"), and active failures, which are errors with immediate consequences (e.g., failure to extend the undercarriage prior to landing; "There have been times when I have made serious mistakes that have affected my operational performance"). Despite the two dimensions of the initial makeup of the scale, Wiggins and Simpson hypothesized that the scale was unidimensional. Nonetheless, Dutcher created three separate subscales from 18 of the 19 items that he used. According to both Dutcher and Febbraro et al, the internal reliability of these three subscales was poor, ranging from -.09 to .50.

2.2.2 Rational Experiential Inventory

The *Rational Experiential Inventory-10 item* (REI-10; Pacini, & Epstein, 1999) is a well-established, valid and reliable scale consisting of two unipolar scales: one measuring rational thinking (*Need for Cognition; NFC*) and the second measuring experiential thinking (*Faith in Intuition; FI*) (see Annex B). Two independent approaches to thinking were assessed with five items each, with a *Need for Cognition* characterized as being intentional, analytic, and predominantly verbal (e.g., "I prefer to do something that challenges my thinking abilities rather than something that requires little thought;" α=.75), and a *Faith in Intuition* characterized as being automatic and intuitive (e.g., "My initial impressions of people are almost always right;" α=.80). Items were rated on a 5-point Likert scale, ranging from *Completely False* (1) to *Completely True* (5). The means of the subscales were computed and analyzed.

[1] Data from a web-based administration of the survey (*N*=129) were excluded from the present analysis due to mean differences in variables across method of data collection. Findings from the web-based survey will be presented in a separate report.

2.2.3 Aviation Gender Attitudes Questionnaire

The *Aviation Gender Attitudes Questionnaire* (AGAQ; Vermeulen & Mitchell, 2007) assessed perceptions of female pilots (see Annex C). The 34-item scale assessed four components of perceptions of female pilots (including female flight students): flying proficiency (i.e., how proficient a female pilot is perceived to be at the task of piloting), safety orientation (i.e., perceptions about the level of safety awareness among female pilots), flight confidence (i.e., perceptions regarding female pilot confidence, assertiveness, and emotional stability), and flight standards (i.e., beliefs that flight training and operational standards are being eroded by allowing female pilots latitude when being tested for their pilot license). Responses ranged from *Strongly Disagree* (1) to *Strongly Agree* (5). Reliabilities of the four subscales reported by Vermeulen and Mitchell, as well as Febbraro et al., were high: flying proficiency (α = .93 & .85, respectively; higher scores were associated with positive perceptions of female pilot flying proficiency), safety orientation (a = .82 & .83, respectively; higher scores were associated with positive perceptions of female pilots' safety awareness), flight confidence (α = .85 & .90, respectively, higher scores were associated with positive perceptions of female pilots' confidence), and flight standards (α = .82 & .74, respectively; higher scores reflected stronger disagreement with the beliefs that flight training standards are being eroded by allowing females latitude when being tested for their license). The means of the subscales were computed and analyzed.

3 Results

3.1 Data Preparation and Screening

Prior to analysis, all variables were examined for missing data.

Of the 222 participants who filled in the paper-based version of the questionnaire, 8 participants (all male) stopped half way through the questionnaire and were, therefore, eliminated. Two participants skipped one page of the FSA scale, resulting in a substantial amount of missing data for that scale (5 and 6 out of 19 items, respectively) and one participant skipped a large proportion of questions from the AGA scale (18 of 34 items) and they were, therefore, also eliminated. For the remaining 211 participants, there was no pattern of missing data. The one exception was the first item in the FSA. Because this item was on the first page, participants appeared to include it as part of the instructions rather than an item and this item was, therefore, skipped by 13 participants. Any missing data points were imputed using the expectation maximization method available in SPSS. This method uses an algorithm to estimate missing variables from the available data.

Two univariate outliers (i.e., $z > |3.29|$, $p < .001$) were converted to the next most extreme case, which is a commonly suggested measure for dealing with univariate outliers (e.g., Kline, 1998). Next, the univariate skewness and kurtosis of the data were assessed. The recommended values for significance of skewness and kurtosis are |2| and |7|, respectively (West, Finch, & Curran, 1995). Violations of normality greater than these suggested cutoffs have been shown to effect the interpretations made in the process of multivariate analyses (Tabachnick & Fidell, 2001). None of the items fell outside of these cutoffs, and therefore, no transformation of data was needed.

3.2 Factor Analysis of Measures

3.2.1 Flight Safety Attitudes

Due to the low reliabilities of the subscales presented by both Dutcher (2001) and Febbraro et al. (2008), an exploratory factor analysis was conducted on the 19 Simpson and Wiggins (1999) items. Extraction was done using a maximum likelihood (ML) procedure, which “estimates factor loadings for a population that maximize the likelihood of sampling the observed correlation matrix” (Tabachnik & Fidell, 2001, p. 610). A direct oblimin (i.e., oblique) rotation, which allows the factors to correlate, was selected.

One convention for selecting the number of factors to be extracted suggests using the number of factors whose eigenvalues are greater than one. In this case, 8 factors had eigenvalues greater than one. However, an analysis of the scree plot, which plots eigenvalues in decreasing order, suggested a 3-factor solution.[2] The factor analysis was again conducted, specifying three factors to be extracted. Items with factor loadings less than .3 on all factors were eliminated since this is

[2] The standard for assessing the number of significant factors based on the scree plot test suggests that the point where a line drawn through the points changes slopes is the appropriate cutoff (Tabachnik & Fidell, 2001).

an indication that the items were not related to any of the factors. Six items were, therefore, eliminated. A final analysis was conducted on the remaining 13 items. Annex D shows the items that loaded significantly on each factor. The names of each factor were based on the common themes of the items loading on each. Factor intercorrelations are reported in Table 1.

Table 1. Intercorrelations of factors derived from the FSA scale.

Variable	1	2
1. Time for HF	--	
2. Operational Performance	.06	--
3. Awareness of Limitations	.06	.05

3.3 Preliminary Statistics

All reliabilities, means, standard deviations, and intercorrelations for the variables used in this analysis were calculated and reported in Table 2. While the reliabilities were, in general, acceptable (.70 or higher), there were some exceptions. The operational performance and awareness of limitations factors of the FSA had low reliability. Unfortunately, an assessment of the individual items in the scales indicated that all of the items were correctly entered and did not need rescaling. Also, no one item in any of the subscales accounted for the low reliability. Therefore, all items were retained and the subscales were used in further analysis; however, interpretation of the results is done cautiously, noting these limitations.

Considering the intercorrelations amongst the variables, not surprisingly, the subscales of the AGAQ were highly correlated. Interestingly, the Safety Orientation subscale was negatively correlated with the other subscales indicating that, rather than female pilots being viewed as safety oriented, they might be viewed as being overly cautious and thus lacking in proficiency and confidence, as well as creating a view that flight standards are reduced for female pilots.

Also as expected, the subscales of the REI-10 were significantly negatively correlated so that participants who were high in NFC were lower in FI. A high NFC was significantly negatively related to beliefs about the lack of time available for Human Factors (HF) and positively related to the operational performance subscale of the FSA scale. NFC was also related to all of the AGAQ subscales; NFC was positively related to the flying proficiency, flying confidence, and flight standards subscales and negatively related to the safety orientation scale. Again it appears that perceptions of being overly safety-conscious impede positive gender attitudes. FI was significantly related to awareness of pilots' limitations in gliding. Interestingly, FI was positively related to safety orientation and negatively related to flying confidence. In other words, those participants who tended to think intuitively tended to also hold positive views of female pilots' safety orientation and negative beliefs about their flying confidence.

Table 2: Means, standard deviations, and intercorrelations of study variables.

Variable	1	2	3	4	5	6	7	8	9
1. Time for HF	.70								
2. Operational Performance	.05	.66							
3. Awareness of Limitations	.02	.04	.48						
4. Need for Cognition	-.14*	.17*	-.03	.76†					
5. Faith in Intuition	-.10	.13	.17*	-.17**	.78				
6. Flying Proficiency	-.06	-.03	-.13	.20**	-.07	.93			
7. Safety Orientation	.01	-.09	.20**	-.15*	.19**	-.47**	.85		
8. Flying Confidence	.02	.02	-.17*	.18**	-.16*	.78**	-.61**	.89	
9. Flight Standards	.00	-.08	-.07	.17*	.01	.52**	-.17*	.38**	.71
Mean	2.76	3.59	3.38	3.57	3.36	3.38	3.20	2.76	3.54
Standard Deviation	.89	.55	.61	.73	.63	.68	.68	.83	.74

Note. Numbers in diagonal indicate Cronbach's alpha for reliability of the scale.

†One item on the NFC subscale of the REI-10 ("*Thinking hard and for a long time about something gives me little satisfaction*") was removed due to a low item-total correlation (.02).

There was no significant correlation amongst the factors derived from the FSA scale. The awareness of limitations subscale, however, was significantly positively related to safety orientation and negatively related to flying confidence. Apparently, the more conscious participants were of pilots' limitations, the more positively they perceived female pilots' safety orientation and the more negatively they viewed female pilots' confidence.

Responses from male and female cadets on all of the variables were compared (see Table 3). Gender differences were only found among the AGAQ subscales. Not surprisingly, female participants believed that female pilots were more proficient and more confident than male cadets did, had a more positive attitude towards female pilots' safety orientation compared to male participants, and felt, more so than male cadets, that flight standards were not being affected by leniency towards female pilots.

3.4 Model Testing

All measurement and structural equation models were analyzed using EQS (Version 6.1; Bentler, 2007). Model fit was assessed with the chi square statistic, the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). The χ^2 statistic is used to assess the difference between the variance/covariance matrix based on the actual data and the matrix reproduced by the model. With respect to the profile of a "good fitting" model, standards indicate that χ^2 should be non-significant, thus indicating a well reproduced matrix; however, this statistic is based in part on sample size, thus allowing for small deviations in actual and predicted matrices

Table 3: *Mean comparison for variables across genders.*

Indicator	Male *M*	Male *SD*	Female *M*	Female *SD*	*t*	*p*	*d*
Time for HF	2.78	0.92	2.68	0.76	0.66	*ns*	.13
Operational Performance	3.62	0.52	3.47	0.61	1.73	*ns*	.26
Awareness of Limitations	3.39	0.63	3.34	0.55	0.49	*ns*	.08
Need for Cognition	3.55	0.71	3.66	0.80	-0.99	*ns*	.15
Faith in Intuition	3.35	0.63	3.41	0.64	-0.63	*ns*	.09
Flight Proficiency	3.23	0.61	3.88	0.66	-6.45	<.01	1.02
Safety Orientation	3.14	0.63	3.39	0.77	-2.27	<.05	.36
Flight Confidence	2.67	0.75	3.07	0.98	-3.01	<.01	.46
Flight Standards	3.41	0.71	3.97	0.67	-4.97	<.01	.81

to result in a rejection of the null hypothesis when sample sizes are large, as they often are in structural equation modeling. A rule of thumb that has been put forth has indicated acceptance of the model when $\chi^2/df < 2$ (Mueller, 1996). The CFI compares the fit of the hypothesized model to the fit of a model in which all of the variables are independent. The RMSEA, on the other hand, evaluates the fit of the model with reference to a saturated model where fit is perfect. CFIs greater than .95 and RMSEAs less than .06 have been widely accepted as indicators of good fit (Hu & Bentler, 1999).

3.4.1 Aviation Gender Attitudes

A confirmatory factor analysis was conducted to assess the validity of the structure of the AGA scale within the student gliding population. Previous research has found the 4-factor structure of AGA to fit well to the data. Therefore, a measurement model was tested such that AGA was hypothesized as a latent variable with four observable variables: Flight Proficiency, Safety Orientation, Flight Confidence, and Flight Standards. An analysis of this measurement model using maximum likelihood estimation indicated a poor overall fit to the data ($\chi^2_2 = 31.25$, $p < .01$; CFI = .91; RMSEA = .26). An analysis of the modification indices suggested the inclusion of a correlation between the error variances of flight proficiency and flight standards.[3] A theoretical argument for the inclusion of this correlated error can be made. Beliefs about the proficiency of female pilots should be negatively related to beliefs that standards are being relaxed in order to

[3] While there has been much debate in the literature over the validity of the inclusion of post-hoc modifications, there is a valid argument for including pathways that were not initially hypothesized in the model if the pathway makes theoretical sense (i.e., is not purely data driven) (e.g., Byrne, 1994). For this reason, the post-hoc modification was made to the AGA measurement model here; however, replication of this model is necessary in order to confirm its validity.

increase the number of female aviators. This correlation is related to beliefs about the relationship between proficiency and standards regardless of gender itself, thus beyond that which is explained by gender attitudes. In other words, the idea that a pilot is a skilled pilot is incompatible with the idea that they were given their "wings" due to the leniency exhibited by an instructor. The same argument cannot be made, however, for either Safety Orientation or Flight Confidence. A safe pilot and/or a confident pilot may not necessarily be a good pilot and these issues are likely unrelated to the idea of leniency except as they are associated with gender attitudes. The model was, therefore, re-analyzed with the inclusion of this correlated error. This model showed excellent fit to the data ($\chi^2_1 = 1.80$, $p = .18$; CFI = 0.99; RMSEA = .06) and was far superior to the original model ($\chi^2_{diff} = 29.45$, $df = 1$, $p < .001$) (see Figure 2).

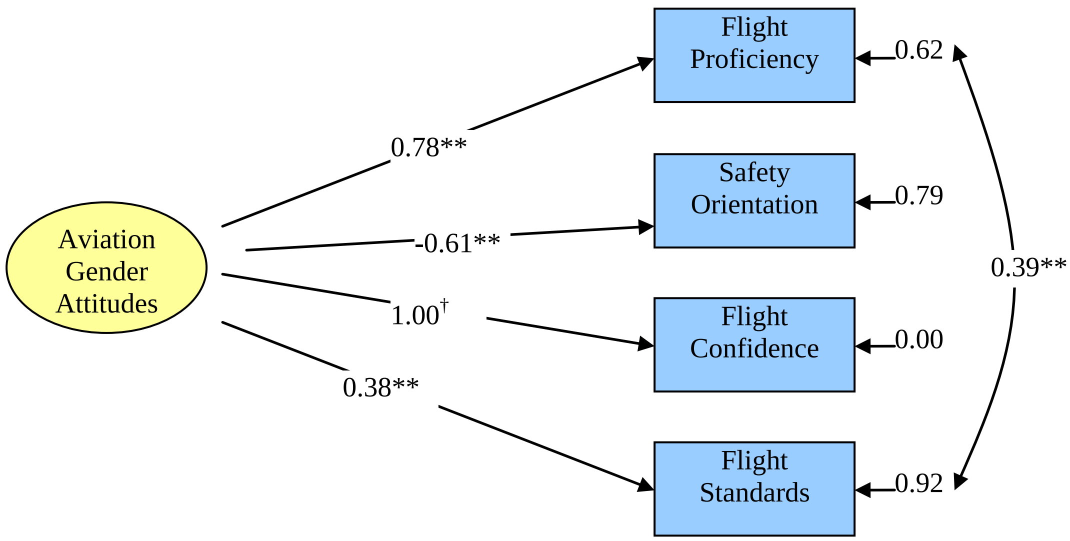

*Figure 2: Measurement model for Aviation Gender Attitudes. Note: ** $p < .05$; † factor loading was fixed rather than estimated in order to create a metric for AGA.*

Despite the gender differences in the means of the indicators of AGAQ, the measurement model fit the data from both genders equally well[4], thus the pattern of results (i.e., that higher levels of safety orientation was associated with lower beliefs in female pilots' proficiency and confidence) held across genders. Thus, the data from male and female cadets were combined in the analysis of the structural equation model.

3.4.2 Structural Equation Model

The hypothesized model tested the impact of beliefs about time available for HF, beliefs about operational performance, awareness of pilot limitations, need for cognition, and faith in intuition on aviation gender attitudes (see Figure 3).

[4] Due to the small number of female participants, the measurement model tested on the females should be interpreted with caution. However, given that this model matched the model for male participants there was a justification for combining the data.

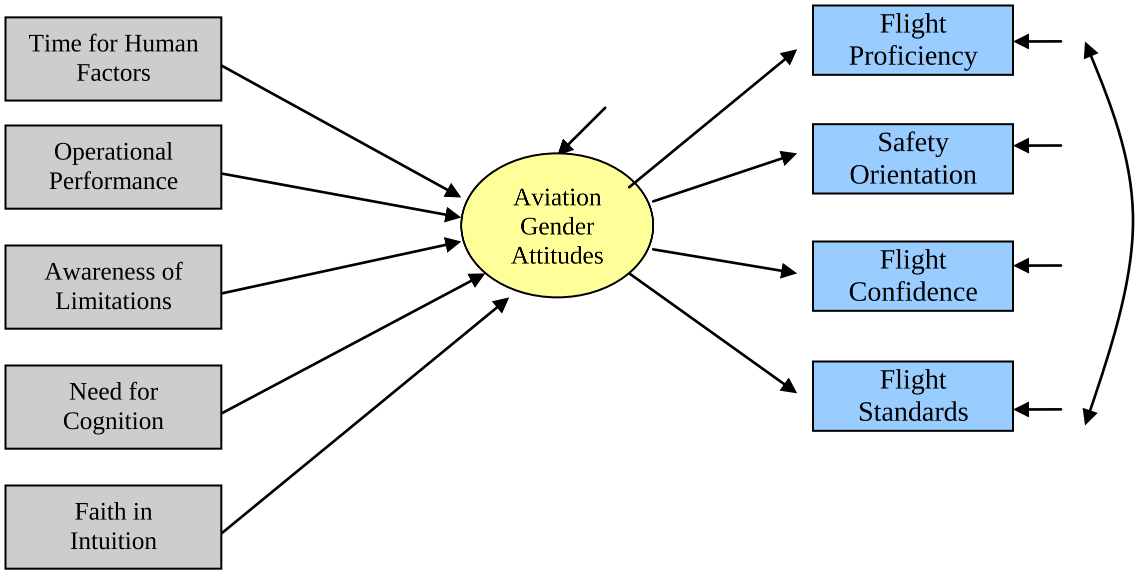

Figure 3: Hypothesized model predicting Aviation Gender Attitudes. Note: all correlations among predictor variables were hypothesized, but not included in this illustration for easy of legibility.

The results revealed that there was adequate model fit to the data (χ^2_{16} = 23.91, p = .09; χ^2/df = 1.49; CFI = 0.95, RMSEA = .05). However, as can be seen in Figure 4, only awareness of limitations and NFC were significant predictors of AGA. Because this model is exploratory in nature, there might be some arguments for removing the non-significant pathways (Byrne, 1996). While doing this does not significantly impact the fit of the model (χ^2_6 = 9.15, p =.17; χ^2/df = 1.52; CFI = 0.99, RMSEA = .05; χ^2_{diff} = 14.76, df = 9, p = .10), it would be best to retain these variables until further validation of the model can be done.

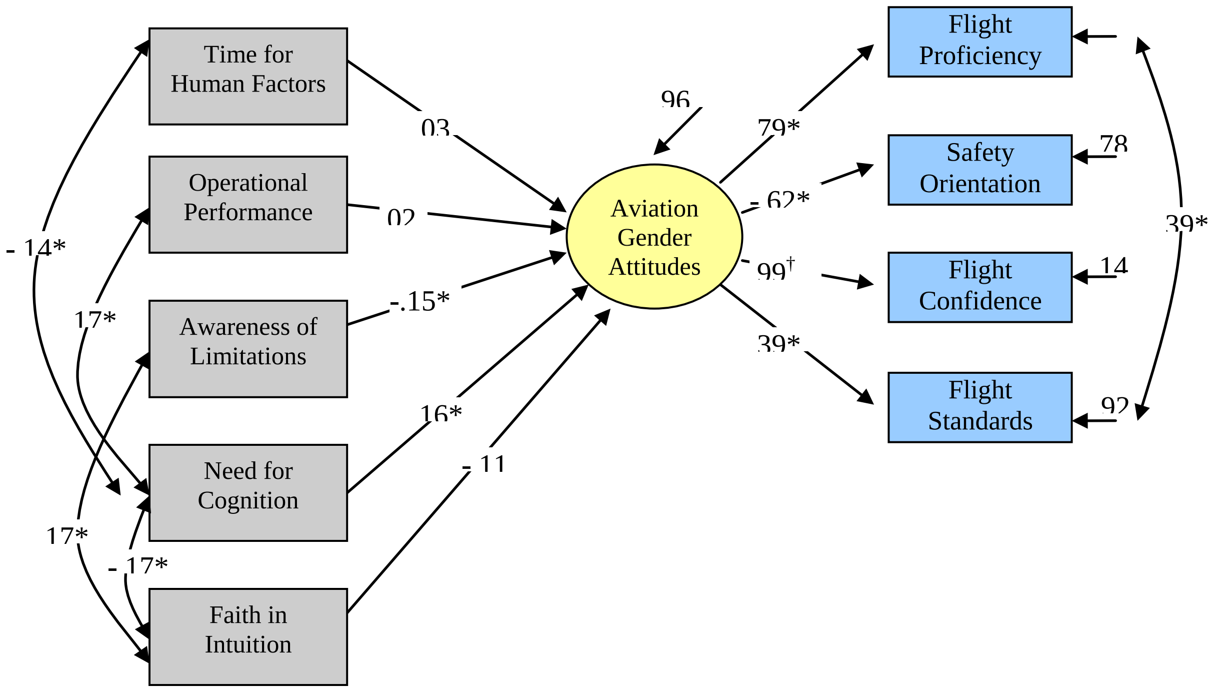

*Figure 4: Standardized maximum likelihood parameter estimates of the model predicting Aviation Gender Attitudes. Only those correlations among predictor variables that were significant were included in the illustration for ease of legibility. Note: * p < .05; † factor loading fixed.*

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4 Discussion

The purpose of the present study was to investigate the potential precursors to circumstances that might lead to stereotype threat amongst females in aviation, specifically in the Canadian air cadet gliding population. Stereotype threat arises when there is a negative expectation with regards to performance based on group membership. Steele and Aronson (1995) showed that under a stereotype threat situation (i.e., a test described as being diagnostic of intellectual ability) Black participants underperformed compared to White participants. However, when the stereotype was nullified (i.e., the test was described as non-diagnostic of intellectual ability), Black participants performed at the same level as White participants. Other researchers have shown this phenomenon to be true in other stereotyped situations as well (e.g., Aronson et al., 1999; Brown & Josephs, 1999; Quinn & Spencer, 2001). The current study was aimed at investigating the attitudes that might be altered in order to nullify stereotype threat in aviation situations.

4.1 Measurement Models

4.1.1 Aviation Gender Attitudes

AGA (a positive attitude towards female pilots) was higher when participants perceived higher flight proficiency and confidence for female pilots and when flight standards were deemed to *not* be unfairly lax for female pilots. Interestingly, safety orientation was negatively predicted by latent aviation gender attitudes. In other words, participants who believed that female pilots had a strong safety orientation (i.e., were more cautious, meticulous, less likely to take risks, etc.) held more negative attitudes towards female pilots than did other participants. This result might be expected when one considers the prevalence of the “Top Gun” mentality. Based on the 1986 film in which a “Maverick” pilot prevails through adversity to become the hero, saving lives and clearly being revealed as the best pilot, the best of the best, this “macho, invulnerability and antiauthority” attitude remains prevalent in aviation (Dutcher, 2001, p. 34) and can be seen in the pattern of relationships between the AGA and other observed measures. Thus, it appears that for a female pilot to be considered truly confident and proficient she must not be overly cautious and she must be willing to make decisions involving risk when flying.

4.2 Structural Equation Model

The purpose of the proposed structural equation model was to predict AGA in order to understand avenues that might be used to change these attitudes. To this end, only two of the five hypothesized contributors were found to predict AGA. Participants who were higher in awareness of pilot limitations (e.g., felt that people got into trouble because they did not know their limits) had more negative attitudes towards women in aviation. One might interpret this finding to mean that stereotypically negative beliefs about women in aviation are related to beliefs that women have greater limitations to their abilities. On the other hand, participants who were higher in need for cognition held more positive attitudes towards women in aviation than did those who were low in need for cognition. In other words, those who had a rational style of thinking were less likely to hold stereotypically negative views of female pilots.

One important finding from the analysis of this model is that the paradoxical relationship between safe piloting and proficient piloting needs to be resolved. As mentioned earlier, Sitler (2004) indicated that female pilots are less likely to be involved in fatal crashes. This may be related to their reluctance to fly in dangerous weather or perform risky moves, which, ironically, may create a more negative attitude towards them and their capabilities. The implication seems to be that if female pilots were truly proficient and confident in their abilities, then they would not be worried about flying in dangerous conditions because they would be able to handle whatever might come their way. Thus, ironically, it appears that in order for attitudes towards female pilots to become more positive, female pilots must become less concerned with safety and act more recklessly. Clearly, this prescription for female pilots is problematic in terms of promoting flight safety. An alternative would be to seek to change attitudes reflecting a “Top Gun” mentality, in addition to promoting a more rational thinking style.

4.3 Limitations and Suggestions for Future Research

4.3.1 Limitations

There are important limitations to the analyses that were conducted. First, the measure of flight safety attitudes that was used in the study was highly problematic. The 19 items adapted from Simpson and Wiggins (1999) did not appear to belong to the same scale. The exploratory factor analysis that was conducted not only revealed a 3-factor solution different from that hypothesized by Dutcher (2001), but it also revealed that the factors were not well sampled as evidenced by the low reliabilities of two of the three factors. The analysis also revealed that these items should likely not belong to the same scale as they were uncorrelated with one another. A more valid and reliable measure of flight safety attitudes would likely uncover an important avenue to improving aviation gender attitudes.

Another concern in this study was the discrepancy in the number of male and female participants. While the test of the model across genders was conducted for this report, it was noted that the small number of female participants renders the testing of this model suspect. It would be important in a future study to have a sufficient number of female participants to test the model across genders.

4.3.2 Suggestions

It has been proposed here that one factor affecting the flight performance of females is stereotype threat. This stereotype threat creates an expectation of negative performance and implies that an individual’s performance will be representative of the performance of the stereotyped group to which the individual belongs. Thus, an individual’s performance has implications not only for that individual, but also for the group with which that individual identifies. In this case, there are negative stereotypes surrounding the performance of female pilots as well as stereotypes about their reactions to criticism and poor performance. These stereotypes suggest that the poor performance of any individual female pilot is likely to be interpreted as not only a representation of her own skills, but as a reaffirmation of the negative stereotype regarding female pilots as a whole.

Preoccupation with, or self-handicapping as a result of, these stereotypes may be one factor contributing to the poorer performance and the higher incidence of accidents involving female pilots compared to male pilots. One aim of future studies might be to assess the performance of female pilots when these threats have been reduced or eliminated. Past research has shown that women who are told that a math test is gender-neutral outperformed women who were told that it was gender-biased (Spencer, Steele, & Quinn, 1999) as well as women who were given no gender information (Walton & Cohen, 2003). In the same way, it might be possible to improve the performance of female pilots by reinforcing the belief that there are no gender differences in performance. Current training standards allow for the differential treatment of male and female cadets. As discussed by Febbraro et al. (2008), instructors acknowledge that they treat female cadets more delicately than they do male cadets. While the intentions of the instructors may be to prevent negative emotional repercussions based on their feedback, the inadvertent result of this treatment is to reinforce and highlight the differences between male and female pilots and the expectations for them.

To assess the extent to which the differential treatment by instructors has an effect on the confidence and performance of cadets, a future study, conducted in a laboratory setting, might be designed such that "instructors" (i.e., participants playing the role of instructor) are trained to treat male "cadets" (i.e., participants playing the role of cadet) in the same way that female cadets are currently treated. A study by Word, Zanna, and Cooper (1974) showed that White participants who acted as interviewers interacted differently with Black interviewees than they did with White interviewees. In a subsequent study, when White participants, now acting as the interviewees, were treated the way that Black interviewees had been treated in the first study, their performance in the interview was altered such that they were judged to be less adequate for the job and more distant from the interviewer. They also judged their interviewer and the interview experience more negatively than participants who had been treated in the same way as the White interviewees in the first study. In the same way, we can expect that the reactions of the male cadets who are treated like female cadets might reflect the reactions of female cadets, thus affecting their confidence and their ability to make quick decisions in stressful situations. Similarly, a subsequent condition in the study might be designed such that instructors are trained to treat female cadets in the same way that male cadets are currently treated. Theoretically, this should result in better performance for female cadets.

The effects of stereotype threat may be more directly assessed in a future study by altering the applicability of the stereotype to the situation. Using a computer-based flight simulator program, participants can be assigned to one of three conditions, one in which the simulation is said to be gender neutral, thus negating the stereotype threat, one in which the simulation is said to be gender biased, thus eliciting the stereotype threat, and one in which no gender information about the simulation is given, thus testing for the automatic activation of the stereotype. If the performance of female cadets in an emergency flight simulation situation is improved when they are led to believe that there exists no evidence of gender differences (i.e., that flight simulator performance is gender-neutral), then it could point to an avenue for the reduction of accidents involving female pilots.

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Annex A Flight Safety Attitudes

Instructions: For each of the following questions, please indicate on the following 5-point scale how much you agree or disagree with each statement. There are no right or wrong answers as your responses reflect your personal attitudes towards flight safety in the context of gliding. Please read the human factors definition below before completing the survey.

Human Factors Definition: Human Factors is a discipline of study that deals with the human-machine interaction. Human Factors deals with the psychological, physical, biological, and safety characteristics of the human and the system the user is in -- for example, how you as a glider pilot (human) interact with the design of a glider aircraft (machine), and how your psychological (e.g., anxiety), physical (e.g., fatigue), and biological (e.g., dehydration) states may affect your ability to fly a glider.

1. There is no time for human factors when split-second decisions need to be made.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. I have never let physical problems influence my performance in the operational environment (i.e., when flying a glider).

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. Effective aviation personnel can leave personal problems behind when in the operational environment.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. The successful management of a critical situation is due solely to operational expertise.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. I can always deal with my stress (i.e., so that it does not interfere with my performance in flying a glider).

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. In critical situations (i.e., concerning gliding), I find it easy to come up with options and choose between them.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

7. In a critical situation (i.e., concerning gliding), most people forget human factors training and revert back to old, well-practiced ways.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

8. With respect to flight safety, if I am in an unfamiliar situation, I would *not* hesitate to ask for help.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

9. Most aviation personnel get into trouble because they don't know their own limits.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

10. I have no time for human factors in critical situations.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

11. Accidents generally occur because people do not follow the rules.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

12. I would easily be able to tell if I were suffering from a physical problem that may affect my performance (e.g., lack of rest, flu, cold, improper nutrition).

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

13. Human factors are more important to the Unit Flight Safety Officer (UFSO) and officers in senior management positions than they are to people at the operational level.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

14. There have been times when I have made serious mistakes that have affected my operational performance.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

15. Most people do not know how to monitor their physical responses.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

16. Most people think accidents will never happen to them.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

17. Professionals in the aviation industry should be able to deal effectively with critical situations.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

18. In the context of gliding, most people can't manage their stress or fatigue levels effectively.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

19. In critical situations concerning gliding, I would probably forget human factors training and revert back to my old, well-practiced ways.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

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Annex B Rational Experiential Inventory

Instructions: For each of the following questions, please indicate on the following 5-point scale whether you view the statement as false or true. There are no right or wrong answers as your responses reflect your personal attitude toward thinking and feeling.

1. I don't like to have to do a lot of thinking.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

2. I try to avoid situations that require thinking in depth about something.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

3. I prefer to do something that challenges my thinking abilities rather than something that requires little thought.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

4. I prefer complex to simple problems.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

5. Thinking hard and for a long time about something gives me little satisfaction.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

6. I trust my initial feelings about people.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

7. I believe in trusting my hunches.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

8. My initial impressions of people are almost always right.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

9. When it comes to trusting people, I can usually rely on my 'gut feelings.'

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

10. I can usually feel when a person is right or wrong even if I can't explain how I know.

1	2	3	4	5
Completely False	False	Neutral	True	Completely True

Annex C Aviation Gender Attitudes Questionnaire

Instructions: This part of the survey is designed to allow you to express ***your opinion*** about male and female pilots. Please read each statement and select the one rating that best expresses your view. **There are no right or wrong answers.**

1. Male pilots are less prone to incidents than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. Male flight students learn piloting skills faster than female flight students.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. Female pilots tend to pay meticulous or close attention to detail.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. Male pilots tend to ‘take charge’ in flying situations more than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. Women often lack the endurance to complete flight school.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. The most likely reason for accidents involving women pilots is poor decision making.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

7. Female flight students are more cautious than male flight students.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

8. Female pilots become fatigued quicker during stressful flights than male pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

9. Female pilots prefer to have information above the required minimum, more so than male pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

10. Male pilots are less nervous when piloting than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

11. Male flight students take greater risks in flying than female flight students.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

12. Male pilots are less likely to make judgment errors in an emergency than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

13. Female pilots prefer to have complete resolution to a problem before taking off, more so than male pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

14. Male pilots make less mistakes when piloting than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

15. Women tend to learn to fly and preflight 'by the book' more so than men.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

16. Female pilots tend to worry too much about insignificant things when flying.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

17. Female flight students tend to experience difficulty in learning to use rudder controls more so than male flight students.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

18. The likely reason for accidents in which female pilots are involved is aircraft mishandling.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

19. Male pilots tend to be more ***assertive*** than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

20. Professional female pilots are only in the positions they are in because airlines want to fulfill affirmative action quotas.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

21. Male flight students tend to respond better to a 'bounce' than female flight students.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

22. Female pilots are more likely to lose control following a spin than male pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

23. Male pilots tend to be more ***confident*** than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

24. When learning to fly female pilots are more safety-oriented than male pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

25. Male pilots are less likely to lose control when landing or taking off in a crosswind than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

26. Male flight students tend to be less fearful of learning spin procedures than female students.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

27. Flight program standards for the airlines/military have been relaxed in order to increase the number of female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

28. Female pilots' decision-making ability is as good in emergency situations as it is in routine flights.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

29. Male supervisors of female pilots often let them get away with a little more because they are afraid of being branded sexist.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

30. Female flight students tend to experience more difficulty in learning radio communication procedures than male flight students.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

31. In a given situation, male pilots will often make a decision quicker than female pilots.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

32. Female flight students may feel intimidated when first learning to fly more so than male flight students might.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

33. Female pilots often lack the leadership ability required to pilot a multi-crew flight.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

34. Flight training standards have been relaxed so that it is easier for women to get their ‘wings.’

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Annex D Rotated Factor Solution for FSA Scale

Time for Human Factors		Operational Performance		Awareness of Limitations	
I have no time for human factors in critical situations.	..996	In critical situations (i.e., concerning gliding), I find it easy to come up with options and choose between them.	.537	Accidents generally occur because people do not follow the rules.	.567
There is no time for human factors when split-second decisions need to be made.	.544	With respect to flight safety, if I am in an unfamiliar situation, I would *not* hesitate to ask for help.	.519	Most people think accidents will never happen to them.	.477
		I can always deal with my stress (i.e., so that it does not interfere with my performance in flying a glider).	.486	Most aviation personnel get into trouble because they do not know their own limits.	.433
		There have been times when I have made serious mistakes that have affected my operational performance. *	.486	The successful management of a critical situation is due solely to operational experience.	.305
		In critical situations concerning gliding, I would probably forget human factors training and revert back to my old, well-practiced ways. *	.433		
		I would easily be able to tell if I were suffering from a physical problem that may affect my performance (e.g., lack of rest, flu, cold, improper nutrition).	.429		
		I have never let physical problems influence my performance in the operational environment (i.e., when flying a glider).	.420		

*Reverse scored item.

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List of symbols/abbreviations/acronyms/initialisms

AGA	Aviation Gender Attitudes
AGAQ	Aviation Gender Attitudes Questionnaire
CFI	Comparative Fit Index
DFS	Directorate of Flight Safety
DRDC	Defence Research & Development Canada
FC	Flight Confidence
FI	Faith in Intuition
FP	Flight Proficiency
FS	Flight Standards
FSA	Flight Safety Attitudes
HF	Human Factors
M	Mean
ML	Maximum Likelihood
NFC	Need for Cognition
NS	Non-significant
R&D	Research & Development
REI	Rational Experiential Inventory
RMSEA	Root Mean Square Error of Approximation
SD	Standard Deviation
SEM	Structural Equation Modeling
SPSS	Statistical Package for the Social Sciences
X^2	Chi-square statistic

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Precursors to Gender Attitudes in the Air Cadet Gliding Population (U)
Signes précurseurs des attitudes liées au sexe chez les Cadets de l'Air pilotant des planeurs (U)

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Emily−Ana Filardo; Angela R. Febbraro; Ritu M. Gill

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(U) Directorate of Flight Safety (DFS) data between 1997 and 2007 suggest that a disproportionate number of female pilots are involved in Canadian air cadet glider accidents. Research also suggests that commercial aviation continues to be dominated by “masculine” cultural values and practices, possibly leading to feelings of pressure among females to perform, as well as prejudicial attitudes towards female aviators (Davey, 2004; Vermeulen & Mitchell, 2007). Research by Febbraro et al.(2008) also found differential treatment of males and females in the Canadian air cadet glider training environment. All of these factors suggest that female air cadets may be exposed to negative attitudes and expectations and may encounter stereotype threat (i.e., negative gender stereotypes) in flight situations. Such negative stereotypes or attitudes could, in turn, play a role in the deficit in performance among female cadets, and possibly contribute to the number of accidents attributed to females. This study explored the precursors to negative gender attitudes in an attempt to identify some of the key factors that contribute to stereotype threat. Structural equation modeling based on survey findings from a sample of male and female air cadets (N = 211) indicated that an awareness of pilot limitations and rational thinking patterns predicted aviation gender attitudes (AGA). Knowing the precursors to negative AGA could point to a mechanism by which these attitudes, and therefore, the environment encountered by female cadets, may be altered to increase their confidence and decrease the stereotype threat, thus potentially leading to fewer accidents.

(U) Les données de la Direction de la sécurité des vols de 1997 à 2007 indiquent qu’un nombre disproportionné de femmes pilotes sont en cause dans les accidents de planeur chez les Cadets de l’Air au Canada. Les recherches indiquent aussi que l’aviation commerciale continue à être dominée par les valeurs et pratiques culturelles « masculines », ce qui peut amener les femmes à se sentir poussées à avoir un rendement impeccable et mener à des attitudes préjudiciables à l’endroit des femmes pilotes (Davey, 2004; Vermeulen et Mitchell, 2007). L’étude menée par Febbraro et coll.(2008) révélait également une différence de traitement entre les hommes et les femmes dans le contexte de la formation de pilotage de planeurs chez les Cadets de l’Air au Canada. Tous ces facteurs indiquent que les femmes pilotes peuvent être exposées à des attitudes et à des attentes négatives ainsi qu’à la menace du stéréotype (stéréotypes négatifs en fonction du sexe) dans une situation de vol. De telles attitudes ou de tels stéréotypes négatifs pourraient entraîner une diminution du rendement des cadettes et, ainsi, contribuer au nombre d’accidents causés par les femmes. Cette étude tente de dégager certains des facteurs clés qui contribuent à la menace du stéréotype en explorant les signes précurseurs des attitudes négatives liées au sexe. Une modélisation par équation structurelle se fondant sur les résultats d’un sondage mené à partir d’un échantillon d’hommes et de femmes appartenant aux Cadets de l’Air (N = 211) a révélé que la connaissance des limites des pilotes et les modes de raisonnement rationnel prédisaient certaines attitudes liées au sexe. La connaissance des signes précurseurs négatifs de ces attitudes liées au sexe pourrait permettre de trouver un mécanisme par lequel ces attitudes (et, par conséquent, l’environnement dans lequel se trouvent les cadettes), peuvent être modifiées pour améliorer leur confiance et diminuer la menace du stéréotype, ce qui pourrait entraîner une réduction du nombre d’accidents.

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thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

(U) gender attitudes; aviation; gliding; stereotype threat; structural equation modeling

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